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(71) Applicant (for all designated States except US): **THE TATA IRON AND STEEL COMPANY LIMITED** [IN/IN]; RESEARCH AND DEVELOPMENT AND SCIENTIFIC SERVICES, Jamshedpur 831 001 (IN).

(72) Inventor: **MUKHOPADHYAY, Ananya**; The Tata Iron And Steel Company Limited, Research & Development & Scientific Services, Jamshedpur 831 001 (IN).

(74) Agents: **DAVAR, G., S. et al.**; L.S. Davar & Co., "Monalisa", Flats 1B & 1C, 17 Camac Street, Kolkata 700 017 (IN).

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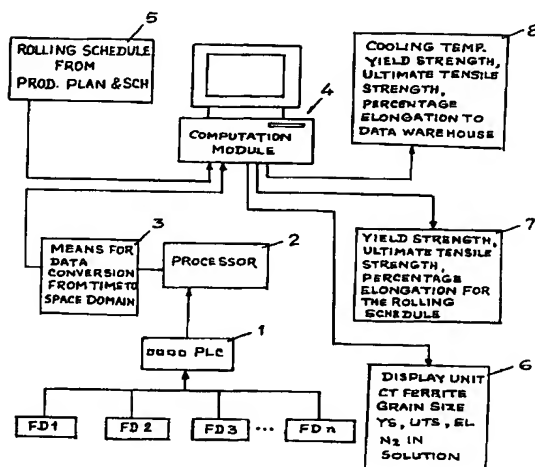
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(54) Title: A SYSTEM AND METHOD FOR ON-LINE PROPERTY PREDICTION FOR HOT ROLLED COIL IN A HOT STRIP MILL



(57) Abstract: This invention provides a system for on-line property prediction for hot rolled coils in a hot strip mill of a steel plant. The system comprises a unit (5) for capturing the chemistry from the steel making stage and providing the data on rolling schedule. Field devices (FD1 ... FDn) are provided at the instrumentation level for measuring process parameters during hot rolling. A programmable logic controller (1) is used for acquiring data of measured parameters from the field devices and feeding the data to a processor (2). Means (3) is provided for conversion of the measured data from time domain to space domain using segment tracking. A computation module (4) processes the converted space domain data for predicting mechanical properties along the length and through the thickness of the strip being rolled. A display unit (6) displays the predicted properties. The data obtained can be stored in a data warehouse (8) for future use. A unit (7) provided in the system can collect the predicted properties and feed the same to the scheduling unit (5).



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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC⁷: B21B 37/00, B21B 38/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC⁷: B21B 37/00, B21B 38/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
epodoc, fi cl txtc, fi cl txtg

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3253438 A (STRINGER) 31 May 1966 (31.05.1966) <i>figs. 1, 3, 4, 8, 10, 11.</i>	1, 2, 7
Y	DE 19941600 A1 (SIEMENS AG) 15 March 2001 (15.03.2001) <i>the whole document.</i>	1, 2, 7
A	US 3568637 A (SMITH) 9 March 1971 (09.03.1971) <i>abstract, fig. 1.</i>	1, 2

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"&" document member of the same patent family

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Patent document cited in search report			Publication date	Patent family member(s)		Publication date
DE	A	19941600	2001-03-15	none		
US	A	3253438	1966-05-31	FR	A	1447915
				FR	A	1381347
				GB	A	982232
				GB	A	982231
				US	A	3248916

AMENDED CLAIMS

[received by the International Bureau on 29 October 2004 (29.10.04);
original claims 1, 12 replaced by amended claim 1; original claim 14 cancelled;
original claim 13 renumbered as claim 12; remaining claims unchanged (3 pages)]

1. A system for on-line display of property prediction for hot rolled coils in a hot strip mill comprising:

- a unit (5) for providing data on rolling schedule with chemistry from the steel making stage;
- 5 - field devices (FD1...FDn) for measuring process parameters during hot rolling;
- a programmable logic controller (1) for acquiring data of measured parameters from said field devices (FD1...FDn) and feeding said data parameters to a processor (2);
- 10 - means (3) for conversion of the measured data from time domain to space domain using segment tracking; and
- a computation module (4) for processing said converted space domain data for predicting mechanical properties along the length and through the thickness of the strip being rolled;
- 15 wherein, said predicted data on mechanical properties outputted from said computation module (4) being stored in a unit (7) for use by said scheduling unit (5) at production planning and scheduling level.

2. The system as claimed in claim 1, wherein said field devices (FD1...FDn) comprise a pyrometer, a speedometer, a thickness gauge, a solenoid valve
20 etc. for measuring data on process parameters.

3. The system as claimed in claim 1, wherein said programmable logic controller (1) is a Westinghouse PLC 26 connected to said field devices (FD1...FDn) through coaxial cable using remote I/O.
4. The system as claimed in claim 2, wherein said programmable logic controller (1) is configured to capture data from said field devices (FD1...FDn) over 0.01 sec. using WESTNET I data highway with Daisy Chain Network topology.
5. The system as claimed in the preceding claims, wherein said processor (2) is an ALSTOM VXI 186 processor and the data transfer between said processor (2) and said programmable logic controller (1) is through WESTNET II using coaxial cable with Token Pass Network topology.
6. The system as claimed in the preceding claims, wherein said computation module (4) is provided with a deformation sub-module (41) for determining final austenite grain size after finish rolling.
7. The system as claimed in claim 1, wherein said computation module (4) further comprises a thermal sub-module (42) for determining the temperature drop during radiation while cooling said hot rolled strip.

8. The system as claimed in claim 1, wherein said computation module (4) further comprises a microstructural sub-module (43) for determining the microstructural changes during phase transformation.
- 5 9. The system as claimed in claim 1, wherein said computation module (4) further comprises a precipitation sub-module (44) for determining the amount of aluminium nitrogen in the solid solution and in the precipitates after cooling.
- 10 10. The system as claimed in claim 1, wherein said computation module (4) is further provided with a structural property correlation sub-module (45) for calculating the yield strength (YS), ultimate tensile strength (UTS) and percentage elongation (EL) based on the phases present.
- 15 11. The system as claimed in the preceding claims, wherein a display unit (6) is provided for displaying a cooling temperature, ferrite grain size, yield strength, ultimate tensile strength, percentage elongation and nitrogen in solid solution/precipitate.
12. The system as claimed in the preceding claims, wherein a data warehousing device (8) is provided for storing the data generated by said computation module (4).